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1. REPORT DATE **30 SEP 2003**	2. REPORT TYPE	3. DATES COVERED **00-00-2003 to 00-00-2003**

4. TITLE AND SUBTITLE **Modeling infragravity waves during NCEX**	5a. CONTRACT NUMBER
	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Delft University of Technology,Faculty of Civil Engineering and Geosciences,,Stevinweg 1 2628 CN,Delft, The Netherlands, , ,**	8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT **unclassified**	b. ABSTRACT **unclassified**	c. THIS PAGE **unclassified**	**Same as Report (SAR)**	**3**	

Modeling infragravity waves during NCEX

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LONG-TERM GOALS

The long-term goal is to develop a morphodynamic modeling capability on the time-scale of months (with a resolution of seconds) and a spatial scale of kilometers (with a resolution of meters) that can be used the predict the beach response (both hydrodynamics and beach-changes) due to changes in wave- and flow conditions with specific attention for low-frequency motions.

OBJECTIVES

The objective of the present project is to examine the effects of offshore edge wave reflections and infragravity wave trapping on the nearshore infragravity wave climate using 2D numerical models that allow for the spatial variability of (infragravity) waves.

APPROACH

A research version of Delft3D will be used to predict the spatial and temporal variation of the infragravity waves within the nearshore during NCEX. Although the model resolves the wave-groups and current-included shear instabilities with 2 samples/sec temporal resolution (Reniers et al, 2003), the focus of this work will be infragravity waves. The cross-shore model domain will start at approximately the 10 m depth going towards the shoreline. The alongshore domain will follow the coast for a number of kilometers, spanning the beach between the two canyons and further north of that. The model requires wave group forcing obtained from frequency-directional short wave spectra at the 10 m depth contour. In view of the complex bathymetry, the short wave conditions will be inhomogeneous due to reflections and wave refraction associated with the canyon walls. The idea is to utilize the co-located puv-measurements along the 10 m depth contour to provide the required spatially varying short wave frequency-directional spectra. In view of the complex bathymetry the role of free incident infragravity waves cannot be ignored. To resolve the trapping and reflection of infragravity waves outside the surfzone, i.e. the canyons, the 2D surfzone model can be coupled to an offshore model (Ardhuin at al., 2001) in collaboration with Ardhuin, Herbers and O'Reilly. To test the nearshore model performance, the computed infragravity frequency spectra will be compared to measurements along the various depth contours within the nearshore zone.

WORK COMPLETED

The proposed work is still in its initial phase as the experiment starts mid-October 2003.

RESULTS

No results yet.

IMPACT/APPLICATIONS

The research is expected to lead to an improved modeling capability of infragravity conditions within the Delft3D modelling package, which is important in view of sediment transport and related morphodynamic response.

TRANSITIONS

RELATED PROJECTS

The proposed work is part of a collaborative effort with Ed Thornton and Tim Stanton of the Naval Postgraduate School. For additional info see
http://science.whoi.edu/users/pvlab/NCEX/vert_structure.html.

REFERENCES

Ardhuin, F., T.H.C. Herbers and W.C. O'Reilly, 2001: A hybrid Eulerian-Lagrangian model for spectral wave evolution with application to bottom friction on the continental shelf. J. Phys. Oc., Vol. 31, No. 6, pp. 1498-1516.

Reniers, A.J.H.M., J.A. Roelvink and E.B. Thornton, 2003: Morphodynamic modeling of an embayed beach under wave-group forcing. To appear in J. Geophys. Res.